

# PERIOPERATIVE CARE OF THE ELDERLY

Shih-Ping Cheng<sup>1</sup>, Tsen-Long Yang<sup>1,2</sup>, Kuo-Shyang Jeng<sup>1</sup>, Jie-Jen Lee<sup>1,3</sup>,  
Tsang-Pai Liu<sup>1,2</sup>, Chien-Liang Liu<sup>1,2\*</sup>

<sup>1</sup>Department of Surgery, Mackay Memorial Hospital, <sup>2</sup>Mackay Medicine, Nursing and Management College, and

<sup>3</sup>Graduate Institute of Pharmacology, Taipei Medical University, Taipei, Taiwan.

## SUMMARY

The geriatric population is growing in number and complexity in modern surgical practice. This challenging group presents differences in physiology and outcomes that make a more comprehensive and multidisciplinary approach necessary. This review emphasizes the meticulous assessment and preparation in all facets before surgery, including a thorough examination, nutrition evaluation and intervention, and preoperative optimization of pulmonary function and cardiovascular hemodynamics. This article highlights the importance of age-related pharmacokinetic and pharmacodynamic considerations, effective pain control, as well as prevention and treatment of hypothermia, fluid and electrolyte imbalance, and postoperative delirium. The vulnerable elderly patient with multiple medical problems and functional impairment is best served by a surgeon with a particular interest and working knowledge of the changes associated with aging and the physiology of surgery and anesthesia. [International Journal of Gerontology 2007; 1(2): 89–97]

**Key Words:** age factors, geriatrics, risk assessment, surgery

## Introduction

Over the last few decades, there has been a remarkable worldwide increase in the proportion of the elderly. Persons over the age of 65 years are the fastest growing segment of the population as a result of increased life expectancy and decreased birth rates. In Taiwan, according to the Council for Economic Planning and Development, the population of people over 65 years of age will comprise 32.89% of the total population by the year 2041. Many surgically treatable diseases become more common with age. Although a reduction in surgical activity may result from better medical therapies or the substitution of less invasive procedures, a previous study showed that aging of the population resulted in a significant growth in the demand for surgical services<sup>1</sup>. Conversely, recent trends indicate a declining medical student interest in certain surgical specialties with a

perceived poor lifestyle, most notably general surgery<sup>2</sup>. Along with the trends that far more aged patients will be operated on, surgeons will be called on increasingly to become familiar with the perioperative problems seen commonly in older patients.

## Age-related Surgical Conditions

Age-related changes lead to altered organ function. Although allowing normal day-to-day functioning, the impact of changes leads to decreased functional reserve even in the absence of coexisting medical disease. Advanced age has been an exclusion criterion for many research studies in the past, with the result that in important clinical areas, there is a paucity of information pertaining to the elderly<sup>3,4</sup>. It has been over 50 years since Welch<sup>5</sup> reported a large series of abdominal operations in patients > 70 years with a perioperative mortality of 20.7%. He concluded that the surgery itself was safe but that senior patients required greater attention in their perioperative management. Nowadays, age bias is still evident in clinical care<sup>6</sup>. For example, approaches to the diagnosis and treatment of breast

\*Correspondence to: Dr Chien-Liang Liu, Department of Surgery, Mackay Memorial Hospital, 92, Section 2, Chung-Shan North Road, Taipei 10449, Taiwan.  
E-mail: [surg.mmh@gmail.com](mailto:surg.mmh@gmail.com)  
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cancer differ significantly in older women<sup>7</sup>. Another example is the observation of an age-related decline in elective inguinal hernia repairs, whereas rates of emergency repair increase exponentially<sup>8</sup>. It is of further interest that the incidence of nonelective presentation of surgical disease tends to rise sharply with age, and meanwhile, nonelective surgical procedures have much higher rates of morbidity and mortality than elective procedures<sup>9,10</sup>.

Elderly subjects are denied surgery because of their presumed higher mortality and morbidity rates, as it used to be stated at the beginning of the last century<sup>11</sup>. Indeed, some studies have suggested that other medical problems, which are more frequent with age, are responsible for the increase in perioperative complications seen in older patients<sup>12–14</sup>. On the other hand, several series have proven no significant differences in postoperative mortality and long-term survival but a slightly higher morbidity in older surgical patients<sup>15,16</sup>. It has been learned that many of these patients can safely be treated surgically, and age should not be the only parameter considered when addressing a medical problem<sup>17</sup>. Improvements in anesthesia, perioperative care and surgical technique now allow many elective procedures to be conducted safely in elderly patients, and functional status and quality of life are often improved after surgery. Nonetheless, it is still common clinical practice to exclude the aged from optimal surgical treatment<sup>16</sup>. When discussing risks and benefits, we must consider not only the risks of the surgery but also the risks of no-surgery<sup>12</sup>. Non-definitive therapy in older patients has been associated with worse outcomes, for example, in patients with colorectal and breast cancers<sup>18</sup>.

## Preoperative Risk Assessment

Chronologic age tells us little about the health or functional status of a person. Aging processes vary markedly among individuals and may influence their ability to withstand stress posed by an operation and anesthesia. Regardless of whether or not elderly patients have overt evidence of organ system dysfunction, these processes will inevitably have reduced function and reserve<sup>19</sup>. The most important predictors of postoperative morbidity and mortality are the urgency of the procedure and presence of coexisting illness. Selected medical conditions, such as diabetes mellitus,

hypertension, coronary disease, cerebrovascular disease, osteoporosis, and smoking, are associated with worse functional outcomes. Exercise and moderate alcohol use were associated with better functional outcomes<sup>20</sup>. It is well recognized that dependency and decreased functionality increases the operative risk<sup>21,22</sup>.

The high prevalence of multiple comorbidities in the elderly necessitates a comprehensive history and physical examination. Although many clinicians assume that the history is less useful in geriatric patients owing to the atypical presentation, sensory loss, and cognitive impairment, important information is still available. The level of support from family or friends should be determined. For those with poor physical function, impaired cognition, or few social supports, preoperative evaluation by other geriatric team members, such as social workers and physical therapists, will be helpful. A careful medication assessment is also essential because adverse drug–drug and drug–disease interactions among older patients are major causes of preventable perioperative morbidity. Oxidative drug metabolism in the liver is slowed in aging. As a consequence, drugs that are metabolized by hepatic oxidation are cleared less rapidly, whereas drugs that are metabolized primarily by glucuronidation are metabolized similarly in young and old subjects<sup>23</sup>. The long list of medications that many geriatric patients are receiving requires clinicians to screen for interactions before adding a medication<sup>24</sup>. The yield of abnormalities from routine blood tests, electrocardiography, and chest radiograph may be higher for older patients. Elderly patients undergoing surgery should repeat these tests if the tests are performed beyond three months prior to admission.

Anesthesiologists have long used the American Society of Anesthesiologists (ASA) physical status system, which was not developed specifically for elderly individuals<sup>25</sup>. The ASA scoring system is highly subjective and prone to interobserver disagreement. Furthermore, the system is not sufficiently sensitive in differentiating the largest proportion of patients falling in the ASA II and III categories<sup>26</sup>. Other physiologic scoring systems are the Acute Physiology and Chronic Health Evaluation (APACHE) and the Physiological and Operative Severity Score for the enUmeration of Mortality and morbidity (POSSUM)<sup>27–31</sup>. The application of APACHE system in the intensive care unit seems very appropriate, but its development to general surgical patients who may not require respiratory support in intensive care unit is limited. The POSSUM consists of two parts: a physiologic score

and an operative score. This second part is highly relevant to the final result. Unfortunately, the necessity to record perioperative variables compromises its usefulness as a preoperative assessment tool.

Perhaps the most commonly applied index is the Goldman cardiac risk index, an instrument designed to assess cardiac risk in noncardiac surgery<sup>32</sup>. The modified cardiac risk index and the algorithm for cardiac risk assessment laid down by the American College of Physicians are applied by anesthesiologists as determinants of outcome<sup>33</sup>. In addition, some geriatric indexes have also been developed. Inouye and collaborators have shown that functional measures are strong predictors of 90-day and 2-year mortality after hospitalization<sup>34</sup>. A functional axis was developed using three independent risk factors: impairment in instrumental activities of daily living, Mini-Mental State Examination score of less than 20, and shortened Geriatric Depression Scale score of 7 or higher. Walter et al.<sup>35</sup> identified six independent risk factors of 1-year mortality in elderly patients: male sex, number of dependent activities of daily living at discharge, congestive heart failure, cancer, creatinine level higher than 3.0 mg/dL, and low albumin level. Another model predicting mortality risk has been proposed recently<sup>36</sup>.

## Preoperative Management

The prevalence of undernutrition and malnutrition in older patients is considerable. Nine percent to 15% of persons over the age of 65 years are found to be malnourished in the outpatient clinics, 12–50% in the acute inpatient hospital, and 25–60% or more in the chronic institutional setting<sup>37</sup>. The older adult may look heavy because of a lifetime of being overweight or the relative increase in body fat with aging, but he or she may still be poorly nourished. Malnutrition is associated with pressure ulcers, confusion, postural hypotension, infections, and anemia. The literature suggests that evidence of the effectiveness of dietary advice and interventions in improving outcomes for older adults has been mixed. In their Cochrane review, Avenell and Handoll<sup>38</sup> commented that many of the studies were of poor quality and advocated caution when drawing any firm conclusions from the results. However, it was suggested that the strongest evidence for the effectiveness of nutritional supplementation exists for oral protein and energy feeds. The enteral route for nutritional support is the route of

choice for all patients unless contraindicated. In general, gastrointestinal function is well preserved with healthy aging<sup>39</sup>. The enteral route, besides being more physiologic, seems to be more appropriate for old persons. Slow administration of a diet is better tolerated than the intravenous infusion of simple sugars to patients with decreased glucose tolerance. Also, the risk of fluid overload is lower when nutrition is enteral rather than parenteral. At a practical clinical level, preoperative nutritional support is most likely beneficial to very malnourished patients<sup>40</sup>. Two weeks of repletion is probably required.

Pulmonary and cardiovascular function in elderly patients may be significantly affected by the aging process. Aging-related deterioration of pulmonary function does not produce symptoms in unstressed individuals. Nevertheless, vital capacity, maximum voluntary ventilation, and respiratory compliance are lower in aging individuals, and the respiratory responses to hypoxia and hypercapnia are markedly diminished<sup>41,42</sup>. Cessation of smoking is helpful but must be undertaken at least 2 weeks prior to surgery<sup>43</sup>. Other important measures include preoperative education on deep-breathing maneuvers and coughing, and use of incentive spirometry. If chronic obstructive lung disease is present, aggressive use of bronchodilators should be implemented both before and after the operation, and where appropriate, antibiotics, steroids, and intravenous aminophylline. In the very obese, weight reduction can improve arterial oxygen levels.

In healthy older individuals, increases in cardiac output are primarily accomplished by increasing end-diastolic volume and stroke volume rather than by increasing in heart rate<sup>44</sup>. There is an overall decline in ventricular compliance, accompanied by increased myocardial and arterial stiffness<sup>45</sup>. Progressive stiffening of the outflow tract and the great vessels results in increased systolic blood pressure and compensatory ventricular hypertrophy. In addition, autonomic tissue is replaced by connective tissue and fat, contributing to the high incidence of sick sinus syndrome, atrial arrhythmias, and bundle branch blocks. For selected patients, it may be prudent to delay surgery to allow for coronary arteriography and possible angioplasty or bypass surgery. In patients at risk for perioperative ischemia, antianginal medications should be maximized. Heart failure should be corrected, and antihypertensives should be continued at the preoperative dose. The most promising approaches, so far, have

used beta-blockade. Studies by Mangano et al.<sup>46</sup> and Poldermans et al.<sup>47</sup> demonstrated the benefit from preoperative beta-blockers in reducing the risk of adverse outcomes at 1-year and major in-hospital cardiac complications in high-risk patients. Sometimes, elderly patients need to undergo an implantation of a pacemaker or valve replacement before they are fit for any major surgical procedure. Indications for evaluation and treatment of cardiovascular risks are provided by the American College of Cardiology and the American Heart Association<sup>48</sup>. Moreover, endocarditis may develop in the elderly, owing to the high prevalence of degenerative valvular disease and the large numbers of older patients undergoing oral, gastrointestinal, biliary, urinary, and pulmonary procedures. If a murmur is present, antibiotic prophylaxis following recommendations of the American Heart Association should be provided<sup>49</sup>.

Medications, such as anticholinergic agents, that may contribute to risk for postoperative delirium should be discontinued unless absolutely necessary. Sedative drugs, such as benzodiazepines, should be tapered rather than suddenly discontinued, because of the risk of withdrawal symptoms. Patients on antiepileptic, cardiovascular, and antihypertensive drugs can take their morning dose with small sips of water several hours before surgery; then, appropriate parenteral alternatives should be used until oral intake is resumed<sup>50</sup>. Aspirin irreversibly inactivates platelet cyclooxygenase and can elevate bleeding times for 7–10 days after a single dose. It is not clear whether aspirin significantly increases the risk of perioperative bleeding or epidural hemorrhage in patients receiving spinal anesthesia. A clinical decision to continue aspirin in patients with coronary artery disease must be based on a careful evaluation of potential risks versus benefits. Oral hypoglycemic agents should be discontinued the night before surgery to reduce risk of perioperative hypoglycemia. Blood glucose levels of greater than 250 mg/dL can be managed with sliding-scale subcutaneous or constant intravenous infusion of short-acting regular insulin. Stable diabetic patients taking insulin should receive one-half their usual dose of intermediate-acting insulin subcutaneously on the morning of surgery and be provided with 5% dextrose intravenously. Finally, patients at risks for adrenal suppression due to recent chronic corticosteroid use should receive stress coverage tailored to the degree of surgical stress.

## Postoperative Management

With aging, the intrinsic function of both the sympathetic and parasympathetic nervous systems decreases<sup>51</sup>. One important consequence of impaired autonomic activity is impaired thermoregulation in response to stress. Older patients cool to a greater extent during anesthesia and require a longer period of time for rewarming<sup>52</sup>. In the early postoperative period, mild hypothermia can elevate norepinephrine concentrations and increase peripheral vasoconstriction and arterial blood pressure, thereby contributing to cardiovascular ischemia and arrhythmia<sup>53</sup>. Mild hypothermia may also increase blood loss during total hip replacement procedures<sup>54</sup> and the risk of wound infection<sup>55</sup>, decrease drug metabolism, and prolong hospitalization<sup>56</sup>. Various combinations of methods, including extra blankets, circulating water mattresses, forced heated air, and fluid warming, have been recommended to maintain core temperatures at greater than 36°C.

Maintaining appropriate perioperative intravascular volume is essential. As a result of the increased afterload caused by stiffening of the outflow tract, the decreased inotropic and chronotropic responses caused by decreased sensitivity to catecholamines, and impaired vasoconstrictive responses, the aging heart depends more on adequate preload. Dehydration from illness, hospitalization, invasive testing, diuretics, and nothing by mouth status, occurs easily in the elderly and may be underappreciated. When large volume resuscitation is necessary as with sepsis, subsequent mobilization may not be as effective as it is in younger patients. In one study that looked at the time course of the mobilization of extracellular water in critically ill medical and surgical patients, the time to restoration of baseline volume was over four times as long in older patients<sup>57</sup>. Hypovolemia can worsen diastolic dysfunction, decrease renal and coronary perfusion, and impair tissue oxygen delivery, leading to myocardial ischemia and wound-healing failures. Tachycardia is less well tolerated in the elderly. Loss of atrial component secondary to atrial fibrillation or shortened left ventricular filling time from any tachyarrhythmia can decrease performance<sup>58</sup>.

Overhydration in a compromised heart must also be avoided as it can lead to systolic failure and poor organ perfusion. In addition, physiologic changes in the kidney decrease the ability to excrete a large volume load. For these reasons, careful monitoring of intravascular volume, by central venous catheters to measure central

venous pressure or pulmonary artery catheters to measure pulmonary artery occlusion pressure, is often helpful to older patients, particularly to those with large blood losses or large volume fluid shifts. Because cardiac output in the elderly is maintained by increased stroke volume rather than increased heart rate, end-diastolic volumes must be higher. Optimum performance, therefore, occurs at a higher point on the Starling curve. Central venous pressure in the range of 8–10 and pulmonary artery occlusion pressure in the range of 14–18 or higher may be necessary to maintain cardiac output<sup>59</sup>.

Previous studies of transfusion thresholds had conflicting results. Hebert et al.<sup>60</sup> suggested a restrictive policy, even in patients with coronary artery disease. However, low thresholds for transfusion may not be appropriate in the elderly. Intraoperative hematocrit of <30% is the only intraoperative factor that predicts delirium in the postoperative period in older patients<sup>61</sup>. Data from patients undergoing radical prostatectomy<sup>62</sup> and vascular surgery<sup>63</sup> showed an increase in myocardial ischemia when intra- or postoperative hematocrit was <28%. Because coronary ischemia is frequently silent in the elderly, care must always be exercised in this age group.

It is important to start nutritional support early in the undernourished and malnourished elderly. After acute illness or injury, resting energy expenditure and oxygen consumption increase to support cardiopulmonary work and the processes of tissue repair and host defense. In the elderly, the magnitude of this increase is smaller, and the hypermetabolic state is less pronounced. When exogenous energy is not provided, endogenous protein stores are mobilized and depleted to meet the metabolic demands. Serum albumin levels fall and hepatic function declines, further impairing adequate endogenous protein synthesis. Decreased muscle mass results in decreased muscle strength, including the respiratory muscles. Dysfunction in those tissues with high cell turnover (the skin, the hematopoietic and immune systems, and gastrointestinal organs) leads to breakdown in barrier function, increased susceptibility to infection, and further impairment in absorption of essential nutrients. One study demonstrated that length of stay and hospital costs was reduced when nutritional support was started within 48 hours and given in sufficient quantity<sup>64</sup>. In contrast, postoperative parenteral nutrition has been associated with increased complications in adequately nourished patients and, therefore, should be used only for those patients with severe

deficits, in whom the gastrointestinal tract is not available. Glycemic control in response to nutritional support may be more difficult in the elderly because the usual insulin resistance of surgery is exacerbated by the declining glucose tolerance associated with aging. In a study looking at age-related differences in metabolic responses to injury, hyperglycemia was more pronounced in the elderly than younger patients<sup>65</sup>. Alternate energy sources such as lipids should be included, and tight glycemic control should be maintained.

Good pain management is essential for a smooth recovery and early rehabilitation. Pain may have a substantial impact on the recovery and may also exacerbate underlying pulmonary or cardiac comorbidities. Fear of pain results in less postoperative activity, thereby increasing the risk of thromboembolism, urinary retention, fecal impaction, and atelectasis<sup>66</sup>. Opioids are the ideal agents for treating the acute postoperative pain because they have no ceiling to the analgesic effect. However, because of the possible adverse effects on respiratory, gastrointestinal, and cognitive function in older patients, ways to diminish the need for opioids are being explored. One approach is to decrease the analgesic requirements by minimally invasive surgery. Given that minimally invasive procedures result in shorter hospitalization, earlier ambulation, decreased postoperative pain, and more rapid return to routine activities, laparoscopic surgery would appear to be the ideal surgical choice for elderly patients<sup>67</sup>. Initially, carbon dioxide pneumoperitoneum raises concern because of the mechanical effects of increased intra-abdominal pressure and the metabolic effects of carbon dioxide. A decade of successful laparoscopic procedures in older patients has reduced fears of pneumoperitoneum-related complications<sup>68</sup>. Even octogenarians seem to benefit from laparoscopic procedures<sup>69</sup>.

A second approach is the more aggressive use of nonopioid analgesics. Parenteral nonsteroidal anti-inflammatory drugs are useful alone or as a dose-sparing adjunct to opioids because of their excellent analgesic effects without the sedation associated with opioids<sup>70</sup>. They should be used with caution in elderly patients with renal insufficiency or gastrointestinal ulcers. A third approach is the use of peripheral nerve blocks or epidural analgesia with local anesthetics, opioids, or both<sup>71</sup>. The local anesthetic agents also provide sympathetic blockade, which ameliorates some of the negative sequelae of sympathetic activation associated with general anesthetics. Local anesthetics, however, can cause



orthostatic hypotension, urinary retention, and muscle weakness, whereas opioids cause urinary retention and itching. Overall, the improved risk/benefit profile of the epidural route justifies the additional invasive procedure. Additionally, patient-controlled analgesia allows for a much more constant level of analgesia (without the peaks and troughs associated with conventional intramuscular injections) and better pain control with fewer complications, less sedation, and better patient satisfaction.

Delirium is the most frequently observed postoperative complication among older patients<sup>72</sup>. Many of the precipitants of postoperative delirium are the same as those causing delirium in medical patients<sup>61</sup>. However, it may be the only manifestation of serious postoperative illness, such as sepsis or myocardial infarction. Delirium can be a very frightening experience for both patients and family members. The approach to such patients is to ascertain the etiology, treat the underlying cause, and control behavior with environmental measures<sup>73</sup>. Strategies that have been recommended to maximize patient safety include regular reorientation and frequent contact by friends, family, and health care staff. It is also important to maintain adequate sleep and hydration, mobility, and sensory input. Unnecessary medications and restraints should be avoided. Low-dose antipsychotic agents may be needed for psychotic manifestations such as hallucinations and violent behaviors. Benzodiazepines are specifically indicated for alcohol or benzodiazepine withdrawal syndromes.

## Conclusion

Health care for the elderly has remained a prominent concern in the literature during the past decades<sup>74</sup>. Aging alone is associated with an overall decline in reserves, and even the fittest elderly do not recover from a major stress as quickly as the young. It has been shown that substantial proportions of patients had protracted disability after elective major abdominal operations and had not recovered to preoperative status by 6 months<sup>75</sup>. Although we, as surgeons, may be pleased with ourselves for successfully getting an older patient through an operation, a poor functional recovery may be even more devastating to that patient. With the increasing numbers of elderly patients undergoing operations, attention to the quality of surgical care is of great importance<sup>76</sup>.

Comorbidity, functional status, depression, cognitive impairment, nutritional status, and insufficient social support have all been shown to affect the survival of elderly patients. Surgery can often be safely conducted but requires meticulous perioperative care to avoid complications and is best accomplished with an integrated, multidisciplinary approach. To minimize postoperative adverse events in the elderly, the following recommendations for clinical management have been proposed<sup>77</sup>:

1. Preoperative assessment to determine the elderly patients at high risk of postoperative adverse outcome.
2. Preoperative testing (invasive or non-invasive) only when test results are likely to change the proposed surgery or intervention, or to indicate the need for high risk invasive monitoring such as pulmonary artery catheterization.
3. Effective perioperative control of coexisting disease.
4. Maintenance of stable perioperative hemodynamics for all elderly patients using vasopressor or vasodilator drugs, or beta-adrenoceptor block, or a combination of appropriate therapies.
5. Where possible, use of a less invasive surgical procedure, e.g., laparoscopy on an ambulatory basis.
6. Intensive perioperative monitoring of high-risk patients.
7. Prevention of hypoxemia, hypothermia, and delirium.
8. Effective postoperative pain control.

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